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09/20/00

September 20, 2000

Asst. Commissioner of Patents  
Washington, D.C. 20231

**PATENT APPLICATION TRANSMITTAL LETTER**

Inventor: Yoshio TOZAWA  
STRUCTURE FOR MOUNTING CAMERAS ON A VEHICLE  
Attorney Docket No.: 32405W053

Sir:

Transmitted herewith for filing are the following:

New patent application including 11 pages of text, 6 sheets of formal drawings, signed Declaration, signed Assignment and Recordation Cover Sheet, Preliminary Amendment, Claim For Foreign Priority w/attached copy of the foreign priority document, and a check for **\$730.00**.

Counsel's check for the fee which has been calculated as shown below.

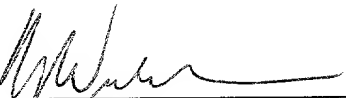
Basic Fee	\$ 690.00
Assignment Fee	<u>\$ 40.00</u>
<b>TOTAL:</b>	<b>\$ 730.00</b>

If any additional fees associated with this communication are required, please notify the undersigned attorney by telephone and charge the fees to Deposit Account 02-4300.

Asst. Commissioner of Patents  
September 20, 2000  
Page 2

This includes, for example, any additional filing fees required under 37 CFR 1.16 and any patent application processing fees under 37 CFR 1.17.

Respectfully submitted,

By   
Robert G. Weilacher  
Reg. No. 20,531

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Applicants: Yoshio TOZAWA

Serial No.: New

Group Art Unit: Unassigned

Filed : September 20, 2000

Examiner: Unassigned

For : STRUCTURE FOR MOUNTING CAMERAS ON A VEHICLE

**PRELIMINARY AMENDMENT**

Assistant Commissioner for Patents  
Washington, D.C. 20231

Sir:

Prior to or concurrent with calculation of the filing fees, please amend this application as follows.

**IN THE CLAIMS:**

Please amend claim 4 as follows.

Claim 4, line 3, delete "or 2".

Please add new claim 5 as follows.

--5. (New) The structure for mounting cameras on a vehicle according to claim 2, further comprising:  
  
falling prevention members for engaging the both ends of said chassis with the vehicle body.--

**REMARKS**

Entry and consideration of this Preliminary Amendment is respectfully requested prior to or concurrent with calculation of the filing fees.

This Preliminary Amendment is being filed to remove the multiple dependent claim to avoid the surcharge.

Examination on the merits is awaited.

Respectfully submitted,

SMITH, GAMBRELL & RUSSELL, LLP

Beveridge, DeGrandi, Weilacher & Young  
Intellectual Property Group

By: 

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September 20, 2000

**TITLE OF THE INVENTION**

Structure for Mounting Cameras on a Vehicle

**BACKGROUND OF THE INVENTION**

5       The present invention relates to a structure for mounting cameras on a vehicle, and more particularly to a mounting structure of cameras which are mounted on a vehicle for obtaining forward environmental data while running in a vehicle drive supporting system.

10       In recent years, a vehicle drive supporting system with a camera mounted on a vehicle has been proposed, wherein information for safety is supplied to a driver, or a vehicle control is automatically performed, based on the forward data in a vehicle running direction which are obtained by the camera  
15 while running.

      Conventionally, as a mounting structure of a camera mounted on a vehicle, a structure described in a publication of Japanese Patent Application Laid-Open No. 11-78717 has been known. The publication discloses a structure for mounting a camera inside  
20 a front windshield (front glass) of a vehicle, or for mounting a camera as a unit on a rear mirror for confirming a rearward direction.

      When the mounting structure described in the above-mentioned publication is applied to so-called stereo cameras  
25 which have one camera on the right and left sides, respectively, two cameras are mounted on each side of a front glass through a stay. However, in this mounting method, there are problems that each position of the both cameras is apt to be relatively tilted because of unavoidable unevenness when manufacturing the front  
30 glass and a vehicle body. If each position of cameras is deviated from a correct position thereof, an accuracy of obtained image data may be lowered. As a result, for example, it may be not accurately performed to measure a distance between an own car and a forward running car, so that the vehicle drive supporting  
35 system can not be accurately operated.

      Furthermore, since the cameras are independently fixed on the front glass through the stay according to the

conventional method, a relative accuracy of an optical axis between the cameras mounted on the both sides is apt to change because of vibration caused while running, a distortion of vehicle body, and a temperature difference inside a vehicle, so that the accuracy of obtained image data is lowered. In addition, a posture such as angle must be adjusted in each camera upon manufacturing, wherein it takes much time to do so. As a result, a productive efficiency thereof is lowered.

## 10 SUMMARY OF THE INVENTION

The present invention has been developed in view of the aforementioned problems, and an object of the present invention is to provide a structure for mounting cameras on a vehicle wherein a relative position between cameras disposed on the both sides can be accurately kept even if vibration while running and/or a temperature difference inside a vehicle influences the cameras, so that an accuracy of the obtained image data is not lowered under any situation.

A first aspect of the present invention is to provide a structure for mounting cameras on a vehicle comprising a chassis having a predetermined length and extended in a lateral direction, a pair of cameras mounted on both sides of a vehicle for making a film of a forward road environment when running, each camera being mounted on both ends of the chassis, and a mounting seat member formed in a center of the chassis, wherein the mounting seat member is fixed onto a predetermined mounting position of a vehicle body so as to mount the pair of cameras on the vehicle body, and portions other than the mounting seat member of the chassis are disposed apart from the vehicle body.

According to the above-mentioned constructions, since the two cameras are mounted on the both ends of the chassis, the relative accuracy of each optical axis between the right and left cameras can be prevented from lowering due to vibration when running or temperature difference. Also, since the chassis is fixed onto the vehicle body with a small compressed area, the image data obtained from the both cameras suffers little influence

of vibration when running, and the like, so that the reliability of a drive supporting system can be improved.

A second aspect of the present invention is to provide the structure for mounting cameras on a vehicle according to the first aspect which a taper plate further intervenes between the mounting seat member and the mounting position on the vehicle body when fixing the chassis onto the mounting position of the vehicle body.

A third aspect of the present invention is to provide the structure for mounting cameras on a vehicle according to the first aspect which a plurality of taper plates are further prepared in advance, the taper plates being formed by wedge-like plates with different taper angle when fixing the chassis onto the mounting position of the vehicle body, wherein the taper plate having the most adequate taper angle of the plurality of taper plates intervenes between the mounting seat member and the vehicle body so as to dispose the pair of cameras mounted on the chassis in the predetermined mounting position of the vehicle body.

According to the above-mentioned second and third constructions, since the taper plate intervenes between the mounting seat member and a front rail of the vehicle body, it becomes easy to adjust the direction of the optical axis of the right and left cameras, so that a manufacturing efficiency can be improved.

A fourth aspect of the present invention is to provide the structure for mounting cameras on a vehicle according to the first to third aspects further comprising falling prevention members for engaging the both ends of the chassis with the vehicle body.

According to the above-mentioned fourth construction, since the falling prevention member is provided on the both ends of the chassis, it becomes easy to mount the chassis onto the vehicle body.

## BRIEF DESCRIPTION OF THE DRAWINGS

These and other objects and advantages of the present invention will become clear from the following description with reference to the accompanying drawings, wherein:

5 Fig. 1 is an explanatory view showing a vehicle drive supporting system having a mounting structure of cameras on a vehicle according to the present invention;

Fig. 2 is a front view of a chassis which is an important portion of the mounting structure of cameras on a vehicle  
10 according to the present invention;

Fig. 3 is a sectional view along A-A line of Fig. 2;

Fig. 4 is a bottom view of the chassis according to the present invention;

Fig. 5 is a side view of the chassis according to the  
15 present invention; and

Fig. 6 is an exploded perspective view of the mounting structure of cameras on a vehicle according to the present invention.

## 20 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A preferred embodiment of a mounting structure of cameras on a vehicle to which the present invention is applied will be explained below with reference to the attached drawings.

FIG. 1 is an explanatory view of a vehicle drive supporting  
25 system using cameras mounted on a vehicle. Figs. 2-6 are views showing a mounting structure of cameras on a vehicle according to the present invention.

First, a summary of the vehicle drive supporting system will be explained hereinafter. The drive supporting system has  
30 a pair of charge coupled device cameras (hereinafter call CCD cameras) 10A, 10B for recognizing a forward road environment while running. An image signal obtained by these CCD cameras 10A, 10B in the vehicle running direction is inputted into an image processing unit 12, wherein the image signal is converted to a  
35 various kind of forward data such as distance data.

Furthermore, the obtained forward data, a road data outputted from a navigation system (not shown), and data of a



vehicle running condition are inputted into a preview control unit (hereinafter call PCU) 14. The PCU 14 raises an alarm with regard to a distance between an own car and a forward running car, and carries out a various kind of control for a drive supporting such as cruise control. Therefore, the high accuracy of the forward data obtained by the CCD cameras 10A, 10B is indispensable for accurately operating the drive supporting system. The object of the present invention is to obtain an exact forward data through improving a mounting structure of the CCD cameras 10A, 10B on a vehicle and thereby raising a relative mounting accuracy between the CCD cameras 10A, 10B.

As shown in Fig. 1, the mounting structure of cameras of the present invention includes a chassis 16 for mounting the two CCD cameras 10A, 10B inside a vehicle as an important parts. The chassis 16 is a member which extends in a lateral direction. The CCD cameras 10A, 10B are mounted on the both ends of the chassis 16 which is formed by only one material having a high-stiffness and a high-coefficient of thermal conductivity such as an aluminum alloy.

On the central portion of the chassis 16 is integrally formed a mounting seat member 17 for fixing the chassis 16 on a front rail 40 of a vehicle body, which partially extends on a rear side of the chassis 16. Two pins 18 are attached onto an upper face of the mounting seat member 17. The pins 18 are engaged with positioning holes of the front rail 40 so as to position the chassis 16 at a predetermined mounting portion. As shown in Figs. 1 and 2, the mounting seat member 17 includes three fixing holes 21 where bolts 42 for fixing the chassis 16 are inserted, as well as the pins 18. The mounting seat member 17 is formed with a width of, for example, only about 50mm, and thus an area for mounting the mounting seat member 17 on the front rail 40 is very small.

When the chassis 16 is fixed on the front rail 40, a wedge-like taper plate 20 intervenes between the mounting seat member 17 and the front rail 40 as shown in Figs. 2 and 3. A plurality of taper plates 20 with different taper angles are prepared in advance so as to enable a vertical angle of an optical

axis of the CCD cameras 10A, 10B to change. As examples of the taper plate 20, there is a taper plate, an front side or a rear side of which is thinly formed, or which is evenly flat. When fixing the chassis 16, the taper plate 20 with a most adequate taper angle is selected, so that the optical axis of the CCD cameras 10A, 10B mounted on the chassis 16 can be minutely adjusted so as to be directed into the predetermined correct direction.

As shown in Fig. 1, on a back face of the chassis 16 are mounted connectors 22A, 22B for outputting an image data obtained by the right and left CCD cameras 10A, 10B. Also, as shown in Figs. 3 and 4, an underside face of the chassis 16 is covered by a circuit cover 24, in which a circuit substrate 26 for controlling each of the CCD cameras 10A, 10B is contained in a space between the chassis 16 and the circuit cover 24. The chassis 16 has a hooked sectional shape extending in a lateral direction to prevent the chassis 16 from being transformed due to a weight of the CCD cameras 10A, 10B and/or an acceleration while running.

The CCD cameras 10A, 10B and the chassis 16 fixed inside a vehicle are covered by an outside cover 27 made of resin, which has engaging portions 28A to be engaged with the chassis 16 at a tip end thereof, and recess portions 28 with a hole where bolts 30 are inserted. The outside cover 27 is mounted at a predetermined portion of the front rail 40 through fastening the bolts 30 into the front rail 40. The recess portion 28 is covered by a cap 32 after fastening the bolts 30.

The chassis 16 is supported on the front rail 40 inside a vehicle by the mounting seat member 17. As shown in Fig. 2, falling prevention brackets 34 are attached on an upper portion of both ends of chassis 16, and split pins 36 on an upper end thereof are inserted into holes (not shown) of the front rail 40. As shown in Fig. 5, the falling prevention bracket 34 is formed so as to cover the both upper ends of the chassis 16 as shown from right to left in Fig. 5. A front portion 34A of the bracket 34 is connected to a front end portion 16A of the chassis 16 through a belt 38 with U-shape shown in the side view in a vehicle running direction. Whereas the belt 38 prevents the

chassis 16 from falling when mounting it, the mounting seat member 17 supports all weight of the chassis 16 including the CCD cameras 10A, 10B after the chassis 16 is fixed to the vehicle through using the taper plate 20. That is, the portions other than the mounting seat member 17 of the chassis 16 are kept under the conditions disposed substantially apart from the vehicle body after being fixed.

As mentioned above and shown in Fig. 6, according to the mounting structure of cameras on a vehicle of the present invention,

the CCD cameras 10A, 10B are mounted on the both ends of the chassis 16, and the mounting seat member 17 disposed in the center of the chassis 16 is attached with fixing holes (not shown) of the front rail 40 by screwing the three bolts 42, so that the chassis 16 can be fixed onto the front rail 40 with a small compressed area.

Thus, the CCD cameras 10A, 10B suffer little influence of vibration when running and of change of temperature inside a vehicle, so that the accuracy of mounting the both cameras 10A, 10B, i.e. of an optical axis thereof can be prevented from lowering. Consequently, the image data of the front environment obtained by the CCD cameras 10A, 10B can be prevented from deteriorating, and the reliability of the driving support system can be improved.

In addition, according to the present invention, the most adequate one of a plurality of taper plates 20 is selected and intervenient between the mounting seat member 17 and the front rail 40, so that an angle adjustment of the CCD cameras 10A, 10B can be easily made.

Furthermore, the chassis 16 supporting the CCD cameras 10A, 10B has enough cross-sectional area, and is formed by a uniform material with high-stiffness and high-coefficient of thermal conductivity. Therefore, a dimensional accuracy between the CCD cameras 10A, 10B is improved, and the thermal conductivity through the chassis 16 is performed quickly, so that there occurs little temperature difference between the CCD cameras 10A, 10B even if daylight is given on only one side, namely a thermal balance between the both cameras can be kept. As a result, an image output

characteristic of the right and left CCD cameras is uniform, and the obtained image data is stabilized.

While there has been described what are at present considered to be preferred embodiments of the present invention, it will be understood that various modifications  
5 may be made thereto, and it is intended that the appended claims cover all such modifications as fall within the true spirit and scope of the invention.

**WHAT IS CLAIMED IS:**

1. A structure for mounting cameras on a vehicle, comprising:  
a chassis having a predetermined length and extended in  
a  
lateral direction;  
a pair of cameras mounted on both sides of a vehicle for  
making  
a film of a forward road environment when running, each camera  
being mounted on both ends of said chassis; and  
a mounting seat member formed in a center of said chassis;  
wherein  
said mounting seat member is fixed onto a predetermined  
mounting position of a vehicle body so as to mount said pair of  
cameras on the vehicle body, and  
portions other than said mounting seat member of the  
chassis are disposed apart from the vehicle body.
2. The structure for mounting cameras on a vehicle according  
to  
claim 1, further comprising:  
a taper plate intervenient between said mounting seat  
member and the mounting position on the vehicle body when fixing  
said chassis onto the mounting position of the vehicle body.
3. The structure for mounting cameras on a vehicle according  
to  
claim 1, further comprising:  
a plurality of taper plates prepared in advance which are  
formed by wedge-like plates with different taper angle when fixing  
said chassis onto the mounting position of the vehicle body,  
wherein  
the taper plate having the most adequate taper angle of  
said plurality of taper plates intervenes between said mounting  
seat member and the vehicle body so as to dispose said pair of  
cameras mounted on said chassis in the predetermined mounting  
position of the vehicle body.

4. The structure for mounting cameras on a vehicle according to

claim 1 or 2, further comprising:

falling prevention members for engaging the both ends of said chassis with the vehicle body.

**ABSTRACT OF THE DISCLOSURE**

Each of the CCD cameras 10A, 10B for making a film of  
5 a vehicle forward road environment is mounted on the both  
ends of a chassis 16 with a high stiffness. A mounting seat  
member 17 is formed at a center of the chassis 16. The CCD  
cameras 10A, 10B are mounted onto a vehicle body through  
fixing the mounting seat member 17 onto the vehicle body.  
10 Portions other than the mounting seat member 17 of the chassis  
16 are disposed apart from the vehicle body.

FIG.1

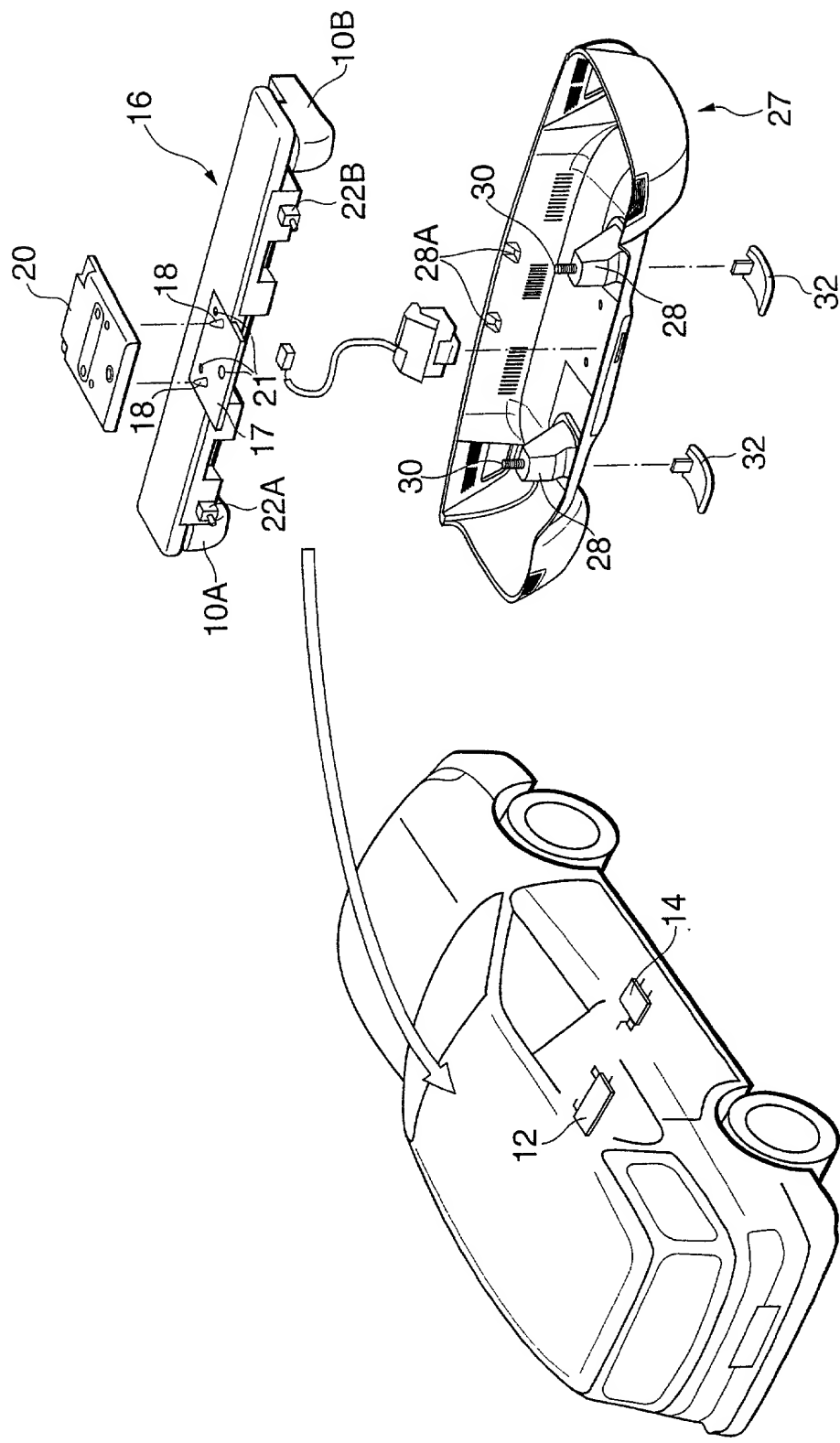




FIG.2

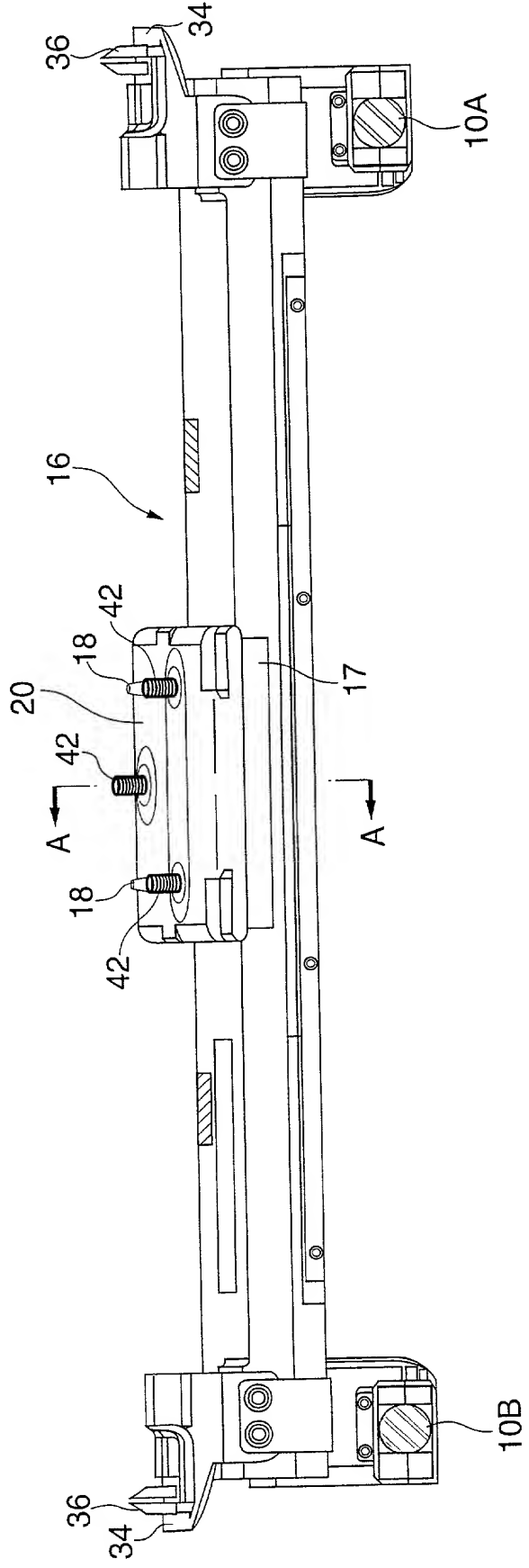


FIG.3

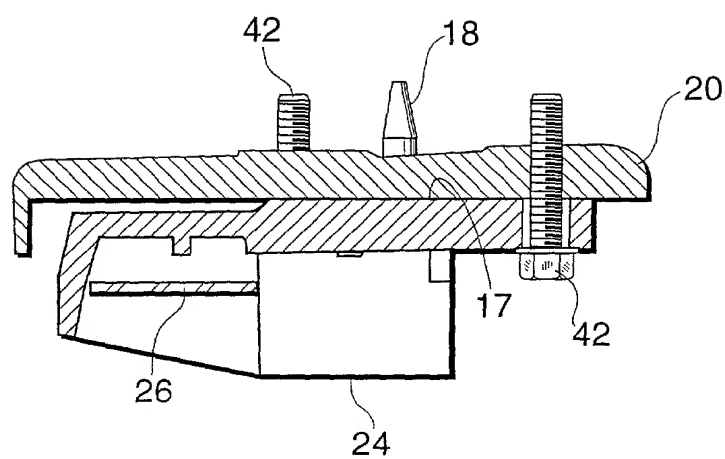


FIG. 4 is a perspective view of the device 10 in an open position, showing the main body 16, the front cover 17, and the rear cover 24. The device 10 includes a display 10A and a camera 10B. The front cover 17 is hinged to the main body 16, and the rear cover 24 is hinged to the rear of the main body 16. The device 10 is shown in a closed position, with the front cover 17 and rear cover 24 covering the main body 16.

FIG.4

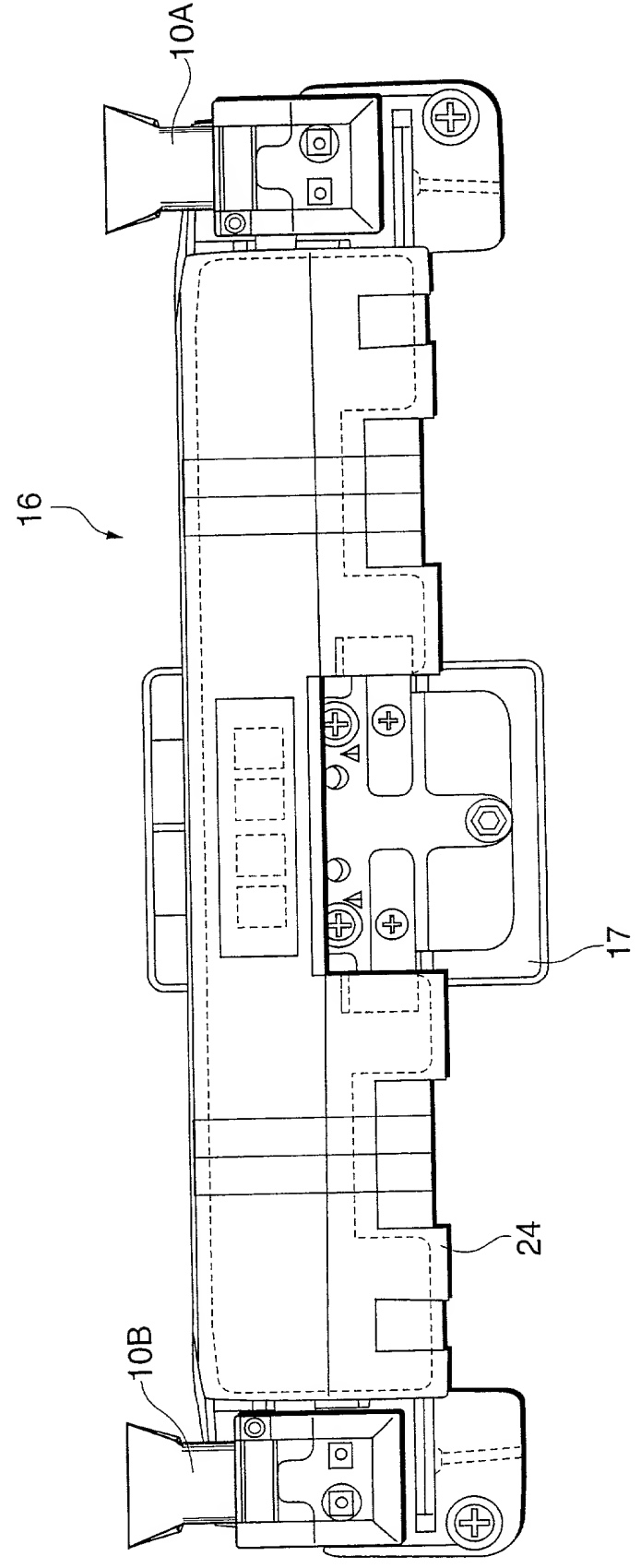


FIG.5

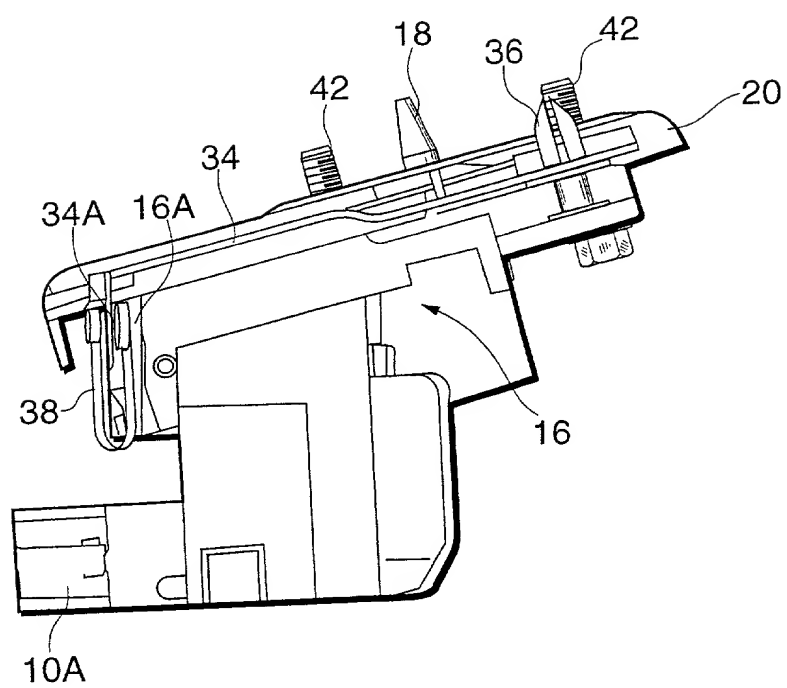
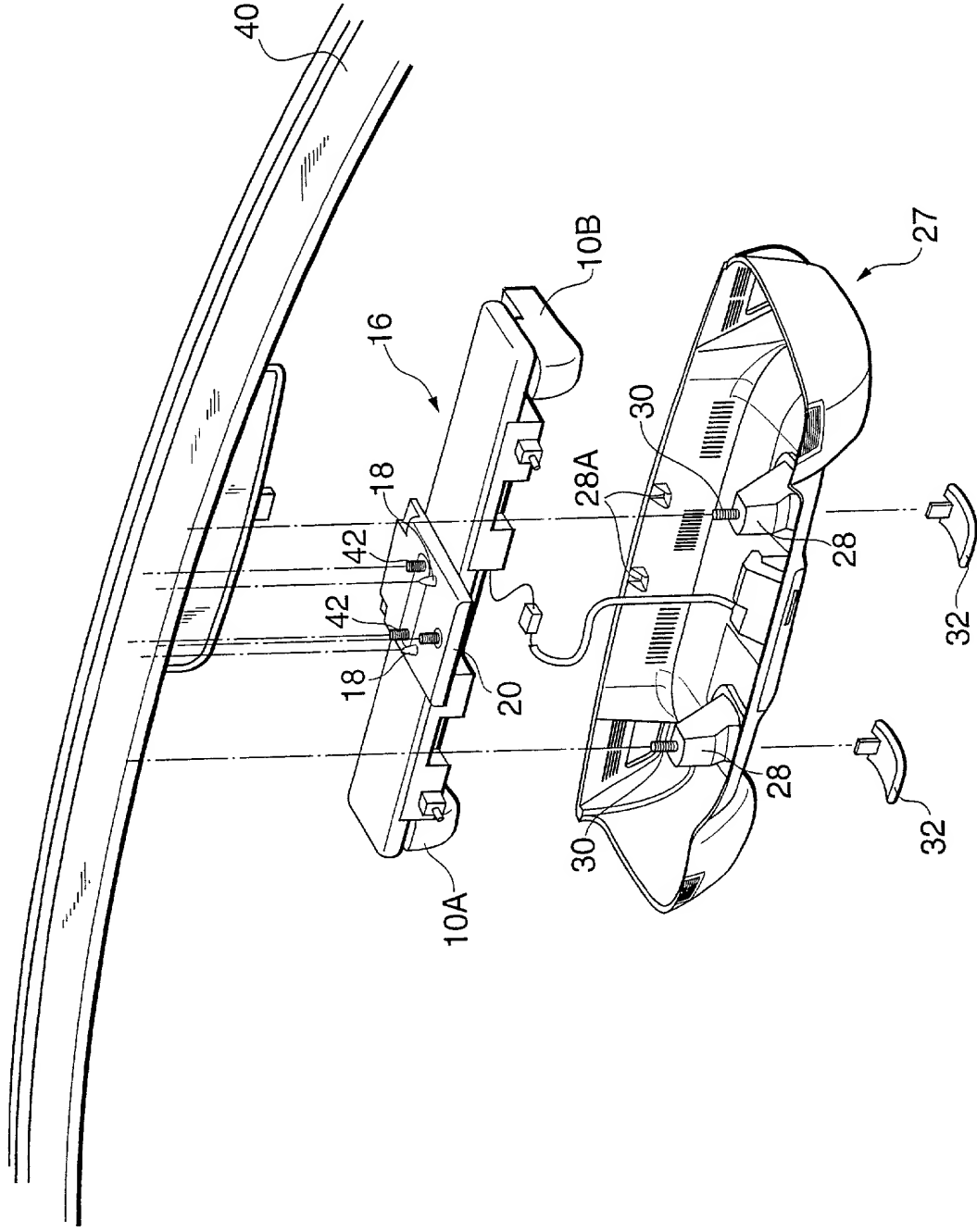


FIG.6



Attorney's Ref. No.:

**Declaration and Power of Attorney For Patent Application**

特許出願宣言書及び委任状

**Japanese Language Declaration**

日本語宣言書

私は、以下に記名された発明者として、ここに下記の通り宣言する:

私の住所、郵便の宛先そして国籍は、私の氏名の後に記載された通りである。

下記の名称の発明について特許請求範囲に記載され、且つ特許が求められている発明主題に関して、私が最初、最先且つ唯一の発明者である（唯一の氏名が記載されている場合）か、或いは最初、最先且つ共同発明者である（複数の氏名が記載されている場合）と信じている。

上記発明の明細書はここに添付されているが、下記の欄がチェックされている場合は、この限りでない:

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この出願の米国出願番号または PCT 国際出願番号は、  
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\_\_\_\_\_ の日に補正された出願（該当する場合）

私は、上記の補正書によって補正された、特許請求範囲を含む上記明細書を検討し、且つ内容を理解していることをここに表明する。

私は、連邦規則法典第 37 編規則 1.56 に定義されている、特許性について重要な情報を開示する義務があることを認める。

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

STRUCTURE FOR MOUNTING CAMERAS

ON A VEHICLE

The specification of which is attached hereto unless the following box is checked:

- ☐ was filed on  
as United States Application Number or  
PCT International Application Number

and was amended on  
\_\_\_\_\_ (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

Burden Hour Statement: This form is estimated to take 0.4 hours to complete. Time will vary depending upon the needs of the individual case. Any comments on the amount of time you are required to complete this form should be sent to the Chief Information Officer, Patent and Trademark Office, Washington, DC 20231. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner of Patents and Trademarks, Washington, DC 20231

## Japanese Language Declaration (日本語宣言書)

私は、ここに、以下に記載した外国での特許出願または発明者証の出願、或いは米国以外の少なくとも一国を指定している米国法典第35編第365条(a)によるPCT国際出願について、同第119条(a)-(d)項又は第365条(b)項に基づいて優先権を主張するとともに、優先権を主張する本出願の出願日よりも前の出願日を有する外国での特許出願または発明者証の出願、或いはPCT国際出願については、いかなる出願も、下記の枠内をチェックすることにより示した。

### Prior Foreign Application(s)

外国での先行出願

1999-269274	Japan	22/September/1999
(Number)	(Country)	(Day/Month/Year Filed)
(番号)	(国名)	(出願日/月/年)
(Number)	(Country)	(Day/Month/Year Filed)
(番号)	(国名)	(出願日/月/年)

私は、ここに、下記のいかなる米国仮特許出願についても、その米国法典第35編119条(e)項の利益を主張する。

(Application No.)	(Filing Date)
(出願番号)	(出願日)

私は、ここに、下記のいかなる米国出願についても、その米国法典第35編第120条に基づく利益を主張し、又米国を指定するいかなるPCT国際出願についても、その同第365条(c)に基づく利益を主張する。また、本出願の各特許請求の範囲の主題が米国法典第35編第112条第1段に規定された態様で、先行する米国特許出願又はPCT国際出願に開示されていない場合においては、その先行出願の出願日と本国内出願日またはPCT国際出願日との間の期間中に入手された情報で、連邦規則法典第37編規則1.56に定義された特許性に関わる重要な情報について開示義務があることを承認する。

(Application No.)	(Filing Date)
(出願番号)	(出願日)
(Application No.)	(Filing Date)
(出願番号)	(出願日)

私は、ここに表明された私自身の知識に係る陳述が真実であり、且つ情報と信ずることに基づく陳述が、真実であると信じられることを宣言し、さらに、故意に虚偽の陳述などを行った場合は、米国法典第18編第1001条に基づき、罰金または拘禁、若しくはその両方により処罰され、またそのような故意による虚偽の陳述は、本出願またはそれに対して発行されるいかなる特許も、その有効性に問題が生ずることを理解した上で陳述が行われたことを、ここに宣言する。

I hereby claim foreign priority under Title 35, United States Code, Section 119 (a)-(d) or 365(b) of any foreign application(s) for patent or inventor's certificate, or 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or PCT International application having a filing date before that of the application on which priority is claimed.

Priority Not Claimed

優先権主張なし

☐
☐

I hereby claim the benefit under Title 35, United States Code, Section 119 (e) of any United States provisional application(s) listed below.

(Application No.)	(Filing Date)
(出願番号)	(出願日)

I hereby claim the benefit under Title 35, United States Code, Section 120 of any United States application(s), or 365 (c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of Title 35, United States Code, Section 112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of application:

(Status: Patented, Pending, Abandoned)	
(現況: 特許許可、係属中、放棄)	
(Status: Patented, Pending, Abandoned)	
(現況: 特許許可、係属中、放棄)	

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

**Japanese Language Declaration**

(日本語宣言書)

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Michael K. Carrier, Reg. 42391;  
Joseph A. DeGrandi, Reg. 17446;  
Thomas L. Evans, Reg. 35805;  
Herbert M. Hanegan, Reg. 25682;  
J. Rogers Lunsford, III, Reg. 29405;  
Michael A. Makuch, Reg. 32263;

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. (list name and registration number)

William F. Rauchholz, Reg. 34701;  
Dennis C. Rodgers, Reg. 32936;  
Charles L. Warner, II, Reg. 32320;  
Robert G. Weilacher, Reg. 20531;  
Richard G. Young, Reg. 20628

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唯一または第一発明者名

Full name of sole or first inventor

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日付

Inventor's signature

Date

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Full name of second joint inventor, if any

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(第三以下の共同発明者についても同様に記載し、署名をすること)

(Supply similar information and signature for third and subsequent joint inventors.)